Left hemi-hepatectomy combined with portal and cavo-atrial thrombectomy for liver tumor under hypothermic cardio-circulatory

Left hemi-epatectomy combined with portal and cavo-atrial thrombectomy for liver tumor under hypothermic cardio-circulatory arrest

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Vascular invasion of portal trunk and supra-hepatic veins extended to the atrium is a major complication of liver tumours. This may produce bleeding from oesophageal varices and/or liver failure, occlusion of the tricuspid valve and/or pulmonary embolism with sudden cardiac arrest.

Therapeutics options at this stage of the disease are few and debatable. The presence of macroscopic vascular infiltration contraindicated liver transplantation and, liver resection with thrombectomy, was the only therapeutic option in this setting .

A 45 years old male with a chronic hepatitis HCV- related was referred to our department for a mass in the left hemi-liver (segments I to IV), occasionally found at US that a contrast enhanced CT scan showed to invade left portal branch and left-middle hepatic veins with tumour thrombi extending toward the right portal branch and the right atrium respectively.

We reported a successful left liver hepatectomy combined with portal and cavo-atrial thrombectomy using hypothermic cardio-circulatory arrest. This technique has been used few times for liver tumours because of the concern for post-operative liver failure and to our knowledge this is the second case reported in literature for primary liver cancer.

Post-operative outcome was excellent with a good liver function. We conclude that this technique should be considered for atrial thrombi removal in patient affected by primary liver tumours in presence of a healthy liver or a well compensated liver cirrhosis in order to prolong the patient's life span.

Key words: **Liver tumours – Atrial thrombus – Portal thrombus – Hypothermic cardio-circulatory arrest – Liver resection.**

HCC is increasingly affecting eastern and western population mainly because of the spread of hepatitis viruses and alcohol abuse. Vascular invasion of portal and suprahepatic veins is a major complication which lead to intrahepatic and systemic diffusion of the tumour. Therapeutics options at this stage are few and debatable. In fact macroscopic vascular infiltration represent a contraindication for liver transplantation and liver resection even with dismal results remains the only possibility in this setting.[1] Portal thrombi may extend producing a complete portal occlusion with bleeding oesophageal varices and/or liver failure. Furthermore the presence of a cavo-atrial thrombus extending from an hepatic vein may cause the occlusion of the tricuspid valve or may embolize in to the pulmonary artery causing a sudden cardiac arrest. For these reasons liver resection combined with portal and/or cavo-atrial thrombectomy should be considered in order to increase the survival time. Liver resection is still the "gold standard" for the treatment of the majority of patients with liver tumours. Portal thrombectomy is a challenging procedure requiring a vascular control of the liver and knowledge of vascular surgery as well as for the invasion of the retro-hepatic vena cava. When the tumour thrombi extend to the supra-hepatic vena cava/right atrium an extracorporeal circulation is usually required.

Case report

A 45 y.o. male known as previous alcohol and drugs user, was followed for a chronic hepatitis HCV- related. An US scan revealed a huge mass in the left emi-liver (segments I to IV), that a contrast enhancement CT scans showed to invade left portal branch and left-middle hepatic veins with tumour thrombi extending toward the right portal branch and right atrium respectively.

Concerning liver function tests, the patient had an increase of colestaic index (alkaline phosphates 145 U/L, glutamine-Tran peptidase 199 U/L and bilirubine 1.11 mg/dl), an increase of AST (60 U/L) and a reduction of serum albumin (3.6 g/dl)

Tumour markers were AFP: 5.5 U/ml (0-10), CEA: 1.8 ng/ml (0-5), Ca-125: 86.9 U/ml (0-35) and Ca 19.9: 64.7 U/ml (0-39). ICG retention test at 15 minutes was 23.5%.

We planned to operate on him and to have less possibility of liver insufficiency we decided to embolized the left hepatic

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artery with lipiodol, doxorubicin and coils. Three weeks after we performed a new CT scan which revealed large confluent necrotic areas within the tumour and scattered distribution of lipiodol mainly in the caudate lobe. We didn't find a lot of difference concerning the volume of the right hemi-liver that we expected hypertrophized owing the presence of a complete thrombosis of left portal branch. There were no difference concerning the extension of the tumour thrombi either in the right portal branch or in the right atrium. From the technical point of view the portal thrombus is usually removable at operation opening the portal vein at its bifurcation with portal occlusion but the atrial thrombi present several problem to solve. We decided to use the same technique used for renal tumours atrial thrombi of removal under hypothermic circulatory arrest. This technique has been used few times for liver tumours because of concern for post-operative liver failure and to our knowledge this is the second case reported worldwide for primary liver cancer.

The operation was performed by liver and cardiac surgeons. The patient placed in supine position was explored through a bilateral sub-costal incision with xifoid extension. No signs of tumour spread outside the liver were found except for enlarged linfonode present in the hepato-duodenal ligament that were removed. The hepatic artery was looped and left hepatic artery and left biliary duct tied and cut. The portal vein was then looped and clamped then incised at its bifurcation. The tumour thrombi was removed from its right branch using forceps, spatula, suction and Fogarty catheter. Once the right portal vein was cleaned it was closed with a prolene suture. Then we move toward the vena cava isolationing its supra and infra-hepatic portion with vessel loop. A careful detachment of the para-caval portion of the liver was then carried out tying and cutting the small accessories hepatic vein up to the right hepatic vein that was encircled with vessel loop at the end. This part of he operation was complicated by chemoembolization and by hypertrophic Spigelian lobe which encircled completely the vena cava with a thick retro-hepatic ligament (Makuuchi's ligament) which had to be divided prior to reach the right hepatic vein. At this point we proceeded with the parenchymal transection using "Kelly crush technique" under intermittent Pringle's manoeuvre along the Cantlie's line. Proceeding toward the vena cava we encountered the middle hepatic vein that was thrombosed at the level of its junction with the left hepatic vein: we cut it between clamps completing the parenchymal resection on the anterior wall of the retro-hepatic vena cava. We completed the detachment tying and cutting the left sided small accessories hepatic vein for the Spigelian lobe and we leave the left hemi-liver attached by means of the trunk of the left and middle hepatic vein. Cardiac surgeons then opened the chest through a median sternotomy and pericardiotomy with a diaphragmatic splitting.

Canulation of the ascending aorta and the right atrium with a "vent" in the right superior pulmonary vein, after systemic heparinization were carried out in order to perform an extracorporeal circulation.

The body temperature was lowered to 24°C resulting in a cardiac fibrillation. No cardioplegyc solution was used and we administrated 30 mg/kg of metilprednisolone, 250 mg of tiopentone and 250 ml of 18% mannitol solution.

Extracorporeal circulation was then stopped. The right atrium was opened, sectioned the trunk of the left and middle hepatic vein and the thrombus removed with forceps and spatula until clean. We closed the atriotomy and the vena cava with prolene suture. The patients was re-warmed to 37°C and he resumed a spontaneous heart beat without the need of defibrillator. While the patient re-warmed we reconstructed the continuity of the middle hepatic vein by means of an interposition PTFE ringed graft of 8 mm in diameter anastomosed to the inferior vena cava with prolene suture. Hypothermic circulatory arrest lasted 14 minutes.

We removed the canulae and correct any coagulator deficiency with the infusion of protamine sulphate and fresh frozen plasma.

We carefully checked the liver transection surface for bleeding and bile leakage. Patients recovered uneventfully except for a right pleural effusion that had to be drained and he was discharged from the hospital three weeks after.

He is actually alive at 6 months with pulmonary metastases.

Discussion

Liver tumour with extension to portal vein and/or hepatic vein represented a controversial issue. The natural history of hepatocellular carcinoma complicated with macroscopic vascular invasion show a median survival time of only 9 to 10 weeks.[2] Treatments with systemic chemotherapy, intra-arterial chemotherapy or radiofrequency ablation result in a dismal survival at 1 year ranging from 7% to 18%.[3-5] Hepatic resection remains however the only option for these patients and a recent multicentric study showed that resected patients lived longer compared to those not treated surgically, with a five-year survival rate of 10%.[6-7] Our patients was hepatopatic because of the presence of HCV infection and previous alcohol abuse. The presence of hepatic vein, vena cava, atrial and portal thrombosis contraindicated liver transplantation and liver resection with thrombectomy was the only therapeutic option. Complete portal thrombosis may result in a severe portal hypertension with bleending oesophageal varices or in a worsening of the liver function.

Furthermore acute pulmonary embolism or congestive heart failure may complicate liver tumours involving hepatic vein with tumours thrombi in the inferior vena cava/right atrium.[8] This latter situation represent a life-threatening condition that should be surgically treated as soon as possible.[9]

Atrial thrombus removal may be achieved under extracorporeal circulation and cardiopulmonary by-pass. Recently extracorporeal circulation with hypothermic circulatory arrest has been increasingly used to remove atrial thrombi due to retroperitoneal malignancies [10] but to our knowledge it has been used only once in cirrhotic patients [9] because of the fear of post-operative liver failure and poor outcome.

In our patients liver function tests and ICG retention test showed a good functional reserve considering that the left hemi liver had no more portal inflow due to the thrombosis and the right branch was partially occluded by a thrombus. We thought that adding an arterial embolization to the left liver could lessen the possibilities of post-operative liver failure according to Ogata *et al.*[11] Furthermore the short lasting hypothermic circulatory arrest had been shown to be safe in well compensated liver cirrhosis.[9]

Post-operative outcome was excellent with a good liver function.

We conclude that this technique should be considered for atrial thrombi removal in patient affected by primary liver tumours also in presence of a well compensated liver cirrhosis in order to prolong patient's life span.

Riassunto

L'invasione vascolare dell'albero portale e delle vene sovraepatiche estesa all'atrio destro è una delle complicanze maggiori dei tumori epatici. Questo può provocare sanguinamento da varici esofagee e/o insufficienza epatica od una occlusione della valvola tricuspide e/o embolia polmonare con conseguente scompenso cardiaco. Le opzioni terapeutiche a questo stadio di malattia sono poche e discutibili. La presenza di infiltrazione vascolare macroscopica rappresenta una controindicazione al trapianto di fegato e quindi la resezione epatica associata a trombectomia è l'unica opzione terapeutica.

Un uomo di 45 anni affetto da epatite cronica HCV correlata è giunto alla nostra osservazione per la presenza di un tumore localizzato a livello dell'emifegato sinistro, che una TC addome con mezzo di contrasto ha dimostrato invadere il ramo portale di sinistra e le vena sovraepatica medio-sinistra con trombosi neoplastica estesa alla branca portale destra ed all'atrio destro rispettivamente.

È stata eseguita una epatectomia sinistra associata a trombectomia portale dx e cavo-atriale in arresto cardio-circolatorio ipotermico. Questa tecnica è stata usata poche volte per i tumori epatici a causa del rischio di insufficienza epatica post-operatoria. Dai dati in nostro possesso questo risulta essere il secondo caso descritto in letteratura. Il decorso post-operatorio è stato eccellente, con una buona funzionalità epatica post-operatoria. Si conclude, quindi, che questa tecnica può essere presa in considerazione per la rimozione di trombi atriali in pazienti affetti da tumori epatici primitivi in presenza di un fegato sano o di una cirrosi ben compensata per aumentarne l'aspettativa di vita.

Parole chiave: Tumori epatici – Invasione vascolare – Resezione epatiche.

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